Title: Go for the Gallon

Brief Overview:

This unit develops standard liquid measure as fractional parts of a gallon with a series of activities and games.

Links to Standards:

- **Mathematics as Problem Solving**
  Students determine the fractional part of a gallon represented by each piece in a set of tangrams if a large tangram square represents one gallon. Students create a tool for learning capacity and a rubric for its evaluation.

- **Mathematics as Communication**
  Students discuss the patterns on their gameboards and write their reasoning in their math journals. Students explain in writing and orally how to use a tool they have made.

- **Mathematics as Reasoning**
  Students decide what fractional part of a gallon various shapes are and explain the reasoning they used to come to their decisions.

- **Mathematical Connections**
  Students connect Spatial Sense, Fractional Parts, and Units of Capacity as they label models showing parts of a gallon.

- **Number Sense and Numeration**
  Students use fractions by showing the relationship between the parts of a gallon (i.e., pints, quarts, and gallons.)

- **Geometry and Spatial Sense**
  Students use tangrams and multilink cubes to represent fractional parts. Equivalent shapes are named with equivalent fractions.

- **Measurement**
  Students develop an understanding of standard measurements of capacity through the use of games.

- **Statistics and Probability**
  Students will organize the data on a gameboard. They will analyze the data to discover patterns and discover the various strategies to win a game.

- **Fractions and Decimals**
  Students use fractional parts in discovering the relationships between pints, quarts and gallons through the use of manipulatives, games, and development of a final project.

- **Patterns and Relationships**
  Students will look for patterns in fractional parts and equivalent fractions through their use of manipulatives.

Grade/Level:

Grades 3-4

Duration/Length:

This unit will take 4 to 5 class periods (45 - 60 minutes) to complete.

Prerequisite Knowledge:

Students should have a basic understanding of fractions.

Objectives:

Students will:

- be able to name the fractional parts of a gallon with equivalent names and equivalent fractions.
- demonstrate understanding of ounce, half-pint, pint, quart, gallon.
- explain their reasoning.
- create a learning tool and share it with other students.
- work cooperatively in pairs.
- examine data and draw a conclusion.
- complete a research assignment.

Materials/Resources/Printed Materials:

- *Math Curse* by Jon Scieszka
- Multilink or Unifix cubes (prepared in packets of 16 same-color cubes; each student will use 3 packets).
- Paper clips to use with spinners
- Crayons (same colors as cubes)
- Tangrams (also available on teacher resource sheets 8 and 9)
- Student and teacher resource sheets 1-9

Development/Procedures:

GO FOR THE GALLON - LESSON 1

Read the book, *Math Curse* by Jon Scieszka out loud to the class.
Elicit responses from the students concerning the book and your rendition of it.

Brainstorm - *What different types math problems did the main character have to solve in the book?* (Write student responses on a chalkboard or overhead projector.)

How did the main character remove the math curse? (By breaking the chalk in half, putting the two halves together to make a whole, putting the hole on the wall and jumping through the hole.)

We are going to look at some problems involving fractions and how they are used in your life everyday.

Opening
Warm-Up Exercise - (3-5 minute problem. Write this on the board for the students to solve.) Give 5 different names for 1 gallon. (i.e., 4 quarts, 8 pints, 16 half-pints, 8 half-quarts, 2 half-gallons, and any other answer is acceptable.)

What are some of the names we give to measure capacity? (Write student responses on the board. Hopefully you will have half-pints, pints, quarts and gallons as part of the responses.) *Let's focus on pints, quarts and gallons.*

I noticed that you said pints. Is there anything smaller than pints that you might see everyday? Hint: You actually see it at lunch in the dining hall/cafeteria. (Response you are looking for is half-pint.)

We want one of our cubes to represent a half-pint. Have the students choose one color to represent a half-pint.

What do you get if you put a half-pint and another half-pint together? (Response you are looking for is a pint.)

We want to choose a color to represent our pints. Have the students choose one color to represent a pint. *Now, put two cubes together to represent a pint.*

What do you get if you put a pint and another pint together? (Response you are looking for is a quart.)

We want to choose a color to represent our quarts. Have the students choose one color to represent a quart. You may want to ask the students, how many cubes are they going to put together to make a quart. *Now, put four cubes together to represent a quart.*

What do you get if you put a quart and another quart together? (Response you are looking for is a half-gallon.) You quite possibly will get the response of a gallon due to the natural progression established. Note that it takes two half-gallons to equal one gallon. You want to arrive at the idea that it actually takes 4 quarts to equal a gallon.

<u>Main Activity</u>
Pass Out Student Resource #1 and Multi Link Cubes (Have your own copy as an overhead.)

Let's first look at the picture noting half-pints. Can anyone tell me how many half-pints it takes to make a gallon? (16) *Color in one of the squares that represents a half-pint. Use the crayon that matches the color of your half-pint. Tell me what fraction of a gallon is one half-pint?* (1/16) Write the fraction 1/16 in one section of the square.

Now let's look at the picture noting pints. Can anyone tell me how many pints does it take to make a gallon? (8) *Color in one of the squares that represents a pint. Use the crayon that matches the color of your pint. Tell me what fraction of a gallon is one pint?* (1/8) Join the cubes you are using to represent pints in pairs. Write the fraction 1/8 in one section of the square.

Finally, look at the picture noting quarts. Can anyone tell me how many quarts does it take to make a gallon? (4) *Color in one of the squares that represents a quart. Use the crayon that matches the color of your quart. Tell me what fraction of a gallon is one quart?* (1/4) Join your cubes to represent quarts in groups of 4. Write the fraction 1/4 in one section of the square.

Pass Out "Go For The Gallon" Game This will include a game board (Student Resource #2), a spinner (Student Resource #6 - pre-cut), and a paper clip.)

We are going to play a game to help us remember different measurements of capacity. You have been given a spinner, a paper clip, and a game board that you will share with your partner to play the game. The rules are to spin the paper clip on the spinner and fill up the gallon space with the correct amount of link cubes. The first person to fill up the gallon space wins the game. There is one more rule. You have to fill up the gallon container exactly. When you are close to filling the container, you have to use the exact amount. You may not overfill the container. (You may want to give the students an example to demonstrate that for them. You may also want to tell them that one strategy may involve skipping a turn. A student does not have to place a cube with every spin.) *Even when one person finishes first, have your partner continue spinning until his/her gallon container is filled.*

After one person wins the game, go to the bottom of the sheet and color with the crayons how your container was filled and then in the spaces next to it, write the fraction representing how many half-pints, pints, and quarts you used to fill the gallon container.

You will play the game three times. Color and note your fractions at the end of each game. You should also note who won each game by circling the gameboard if you were the winner.

You will want to collect all the games as they are completed and post them on the chalkboard or you can make it into a bulletin board or other type of display. Have the students observe all the different ways their classmates filled their gallon containers. Ask the students to state anything they observe and note their responses on a chalkboard or overhead projector.

Concluding Activity
Pass Out Student Resource 3 "Go For The Four Gallons" Game

The students will play the same game with their partner but this time, they will fill a four gallon container. The students will color and write the fractions of the whole as they did with the one gallon container. After they fill their four gallon container, they will color their game board and the board can also be displayed. (Note: This game changes the whole from one gallon to four gallons. Thus, one gallon is now a fractional part (1/4) of the whole.)

GO FOR THE GALLON - LESSON 2

Opening
Warm-Up Exercise - (3-5 minute problem. Write this on the chalkboard for the students to solve.) A cup is another name for a half-pint. A cup is what fraction of a pint? (1/2) A cup is what fraction of a quart? (1/4) A cup is what fraction of a gallon? (1/16) Explain your reasoning.
Elicit student responses and write them on the chalkboard.

Does anyone know what an ounce is? (Check student responses. If no one knows, explain how it is a unit of liquid measurement and a unit of weight. However, we will only be discussing it as a unit of liquid measurement.)

Already have prepared on the chalkboard this information and questions: one cup = 8 ounces. Ask the students to respond to these questions. How many fluid ounces are in a pint? (16 ounces) How many fluid ounces are in a quart? (32 ounces) How many fluid ounces are in a gallon? (128 ounces) Ask them to respond to these questions. (You may need to remind them about the warm-up exercise to help them.)

To make it easier for everyone, we will now refer to fluid ounces as ounces hereafter. We will still mean fluid ounces throughout today's lesson.

Main Activity

Pass Out Student Resource #4 and Multi Link Cubes (Have your own copy as an overhead.)

Let's first look at the picture noting cups. You may use your link cubes to help you answer these questions. Remember how many cubes represent a cup, a pint and a quart.

Can anyone tell me how many cups does it take to make a gallon? (16) *Using ounces, tell me what fraction of a gallon is one cup?* (8/128 or 1/16) *Write the answer in a section of the gallon.* (Note: Be sure to allow for any equivalent fractions.)

Now let's look at the picture noting pints. Can anyone tell me how many pints does it take to make a gallon? (8) *Using ounces, tell me what fraction of a gallon is one pint?* (16/128 or 1/8) *Write the answer in a section of the gallon.*

Finally, look at the picture noting quarts. Can anyone tell me how many quarts does it take to make a gallon? (4) *Using ounces, tell me what fraction of a gallon is one quart?* (32/128 or 1/4) *Write the answer in a section of the gallon.*

Does anyone see a pattern with what we did yesterday? (The idea is to note that the two fractions are equivalent. In other words, they are different names for the same thing.)

Pass Out "Go For The Gallon" Game (This will include a spinner - Student Resource #6, paper clip, and game board - Student Resource #5.)

We are going to play the "Go For The Gallon" game again but we have changed the spinner this time noting the different names we have learned for half-pint, pints, and quarts. to help us remember different measurements of capacity. You have been given a spinner, a paper clip, and a game board that you will share with your partner to play the game. The rules are to spin the paper clip on the spinner and fill up the gallon space with the correct amount of link cubes. The first person to fill up the gallon space wins the game. There is one more rule. You have to fill up the gallon container exactly. When you are close to filling the container, you have to use the exact amount. You may not overfill the container. (You may want to give the students an example to demonstrate that for them.) *Even when one person finishes first, have your partner continue spinning until his/her gallon container is filled. You will play this game three times.*

Concluding Activity (The students may do this activity alone or with a partner.)
Pass Out Tangram Gallon Activity - Student Resource #7 (Class sets of tangram pieces may be used or the students may cut their own from Student Resource Sheets #8 or #9.)

We are going to try one more thing to check what you have learned about liquid measurement. You are going to be given a set of tangrams. The first thing you need to do is use your tangrams to make one large square. After you have made your square, I want you to think of that square as representing one gallon. Your job will be to determine what fraction of a gallon is each piece of the tangram. You will use your math journal to explain why you named two non-duplicate pieces the way you did. Be sure to use the fraction words we have been learning in class the past two days.
(Note: With some classes you may need to provide the terms such as: quart, pint, 1/2 pint, cup, 1/2 quart, 1/4 gallon, 1/8 gallon, 1/16 gallon, 8 ounces, 16 ounces, and 32 ounces.)

If the students complete the tangram activity early, they may work on the homework assignment in class. (Student Resource #10)

Homework Example: Answer the following questions. You may have to use a dictionary to research some of the answers.
1. There are 31 and 1/2 gallons in a barrel. How many gallons are in two barrels? (63 gallons)
2. What is a hogshead? (2 barrels)
3. What fraction of a hogshead is one gallon? (1/63)

GO FOR THE GALLON - LESSON 3

Opening
Review last night's homework.

Warm-Up Exercise: (Have this written on the chalkboard.) Work with your partner or cooperative group on this idea. Think of as many things you could create to help someone learn about units of capacity and their fractional parts. Have one person in your group record your ideas. (Note: You may need to review some of the terminology that has been used in previous lessons, i.e., pints, cups, ounces, etc.)

In this lesson, the students will design a tool for other students to use to learn about the units of capacity and their fractional equivalents. After you have given the students some time to brainstorm their ideas in their cooperative teams, have the students share their ideas and write their responses on the chalkboard. (These are some sample ideas.)

- Flash cards
- Poster
- Collecting containers that hold different capacities
- Create a song or skit
- Create a game, such as concentration

Each cooperative group will need to select a tool they will create. They may use any of the ideas listed on the chalkboard or any other they may have thought of. You will want to be sure to approve each groups' idea.

You can either use the rubric that we have designed or you may want to allow the students as a class to create their own. The rubric is designed to evaluate the students' final product. If you want to allow the class to design a rubric, you might follow these suggested guidelines. Ask the students what they think they need for an excellent product. Try to elicit these responses. It should include: references to different measures of liquid capacity (such as half-pint, cup, pint, quart, gallon, and ounce) or fractions and fractional equivalents; neatness of the product; cooperation between partners; and a detailed written description of the tool and a complete set or rules.

Pass out Student Resource #11. The students will need to write a description of their tool and how it is to be used. For example, if the tool is a game they need to give the rules for the game and describe how it is to be played. They should make a list of the materials they will need to make their tool. (This will enable you to gather the things needed for their projects.) The students will spend the remainder of the class designing their tool. (BE PREPARED: Some students may need an extra day to prepare their tools.)

GO FOR THE GALLON - LESSON 4

In this lesson, the students will present their tools to the other members of the class. You will want each student to evaluate their tool based upon the rubric established in class or presented in this learning unit.

You can do various things at this point. You can have students in the class exchange tools and work with other students projects. You may want to coordinate with another class to have your students come in and share their projects and teach that class about liquid capacity and fractions. Your creativity is a definite advantage at this point in the lesson.

Performance Assessment:

Ongoing assessment is by teacher observation, completion of student resource sheets and journal writing. Final performance assessment evaluates student created projects according to a rubric designed by the class. You may utilize the rubric included with this learning unit (see Teacher Resource 12) as your assessment tool or as a guide for developing a rubric with the students.

Extension/Follow Up:

Metric units of capacity can be compared to the standard units taught in this unit.

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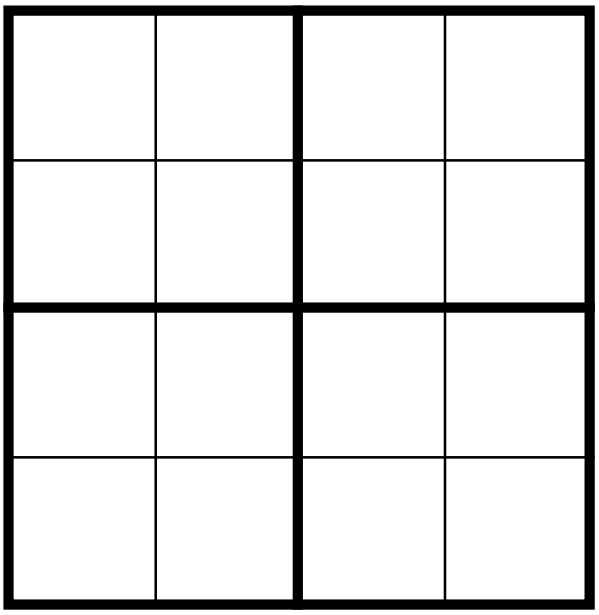
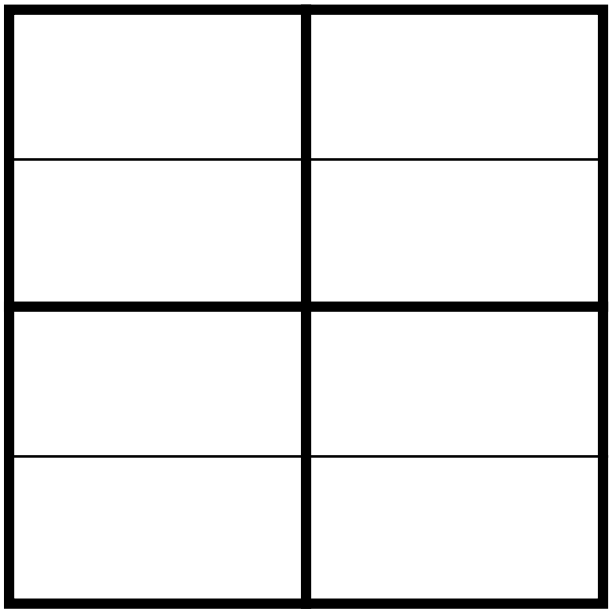
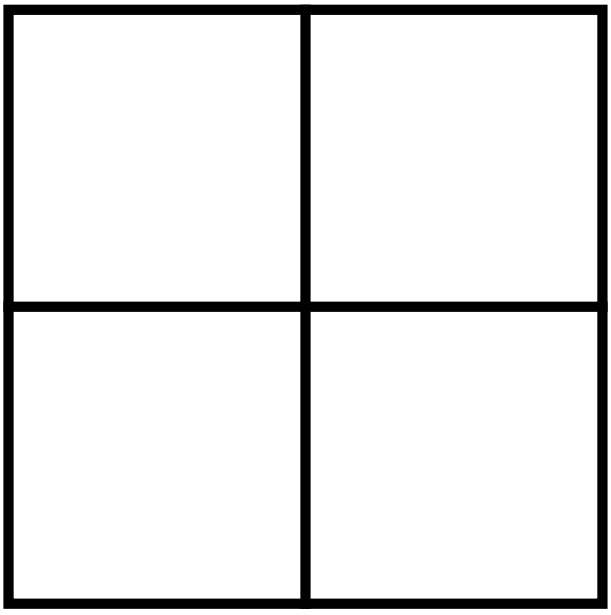
Go for the Gallon - Student Resource 1a
(Multilink Cubes)



Half-pints

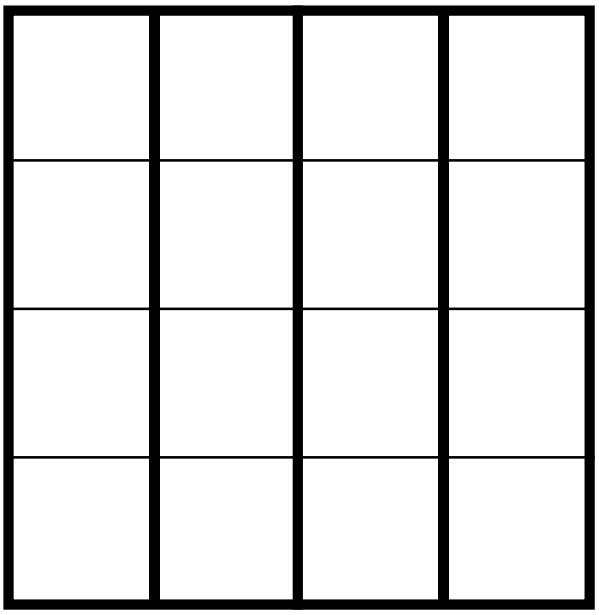


Pints

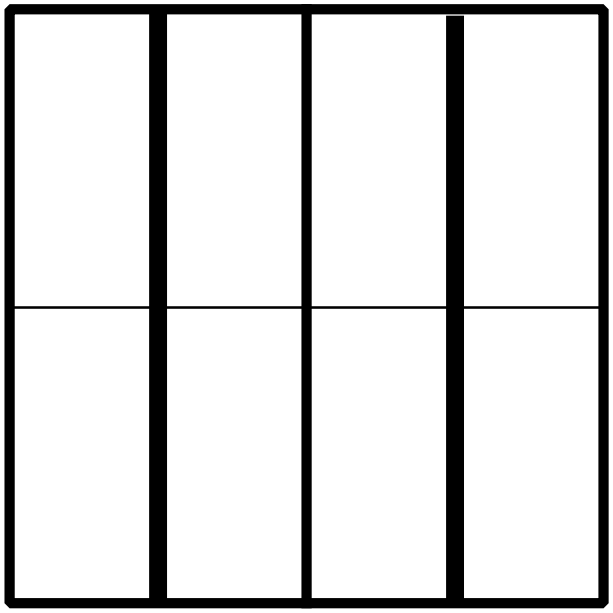


Quarts

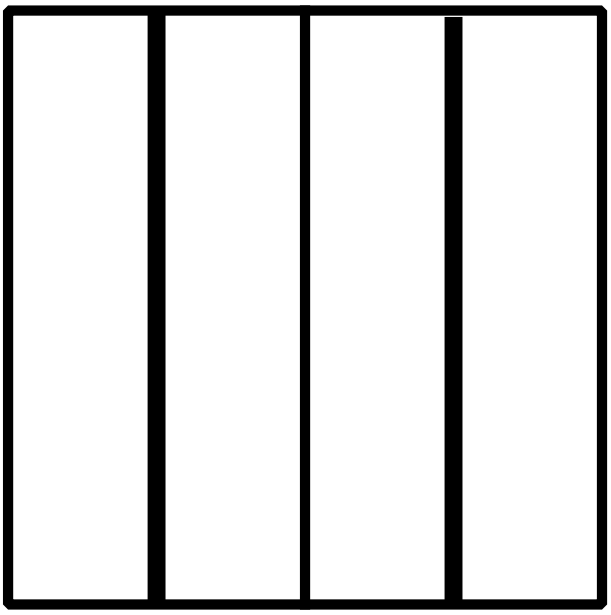
Go for the Gallon - Student Resource 1b
(Unifix Cubes)



Half-pints

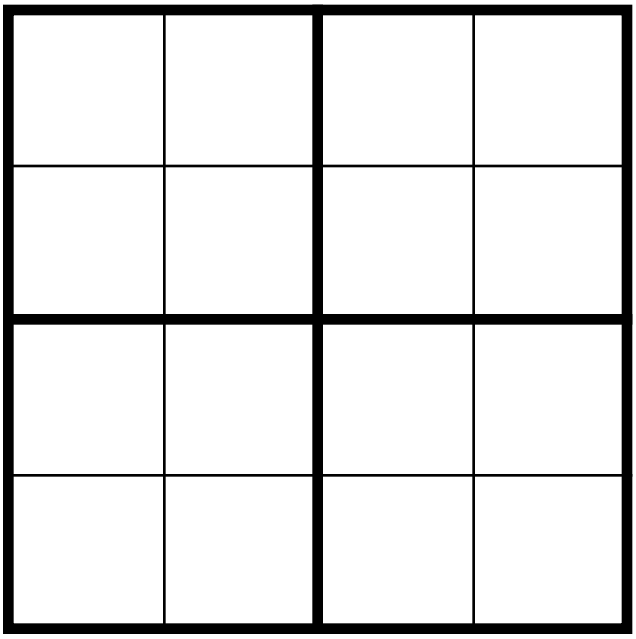


Pints

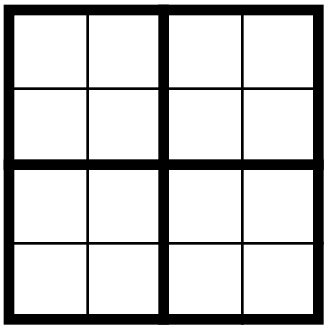


Quarts

Go for the Gallon



Game 1



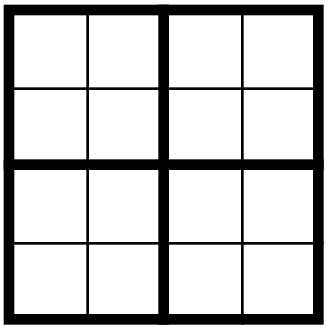
What fraction of your gallon is ...

half-pints _____

pints _____

quarts _____

Game 2



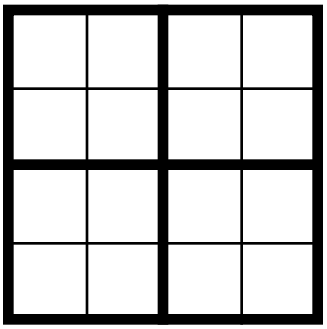
What fraction of your gallon is ...

half-pints _____

pints _____

quarts _____

Game 3



What fraction of your gallon is ...

half-pints _____

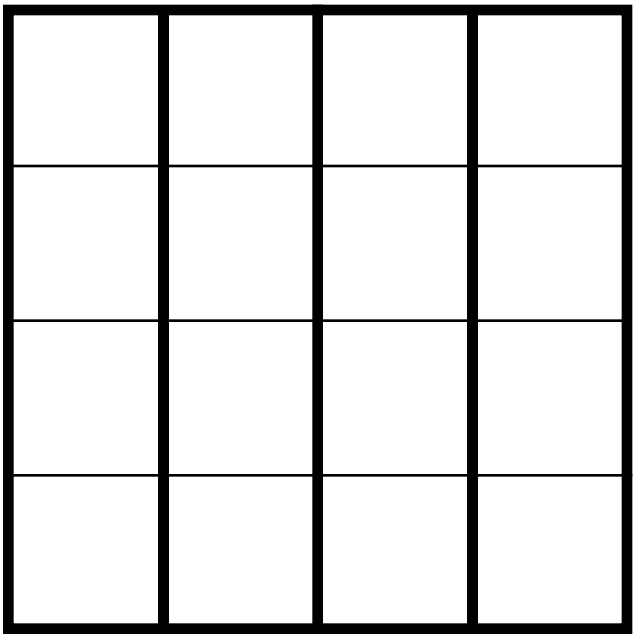
pints _____

quarts _____

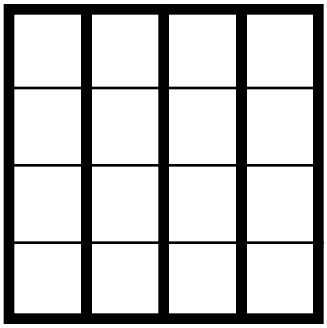
MATH JOURNAL QUESTION

What is the easiest way to win this game? Explain your reasoning.

Go for the Gallon



Game 1



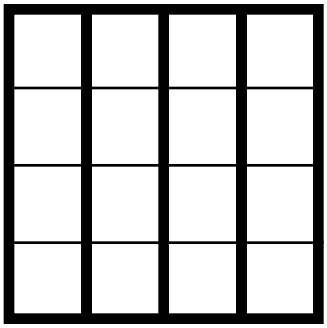
What fraction of your gallon is ...

half-pints _____

pints _____

quarts _____

Game 2



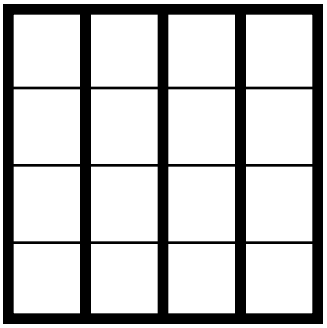
What fraction of your gallon is ...

half-pints _____

pints _____

quarts _____

Game 3



What fraction of your gallon is ...

half-pints _____

pints _____

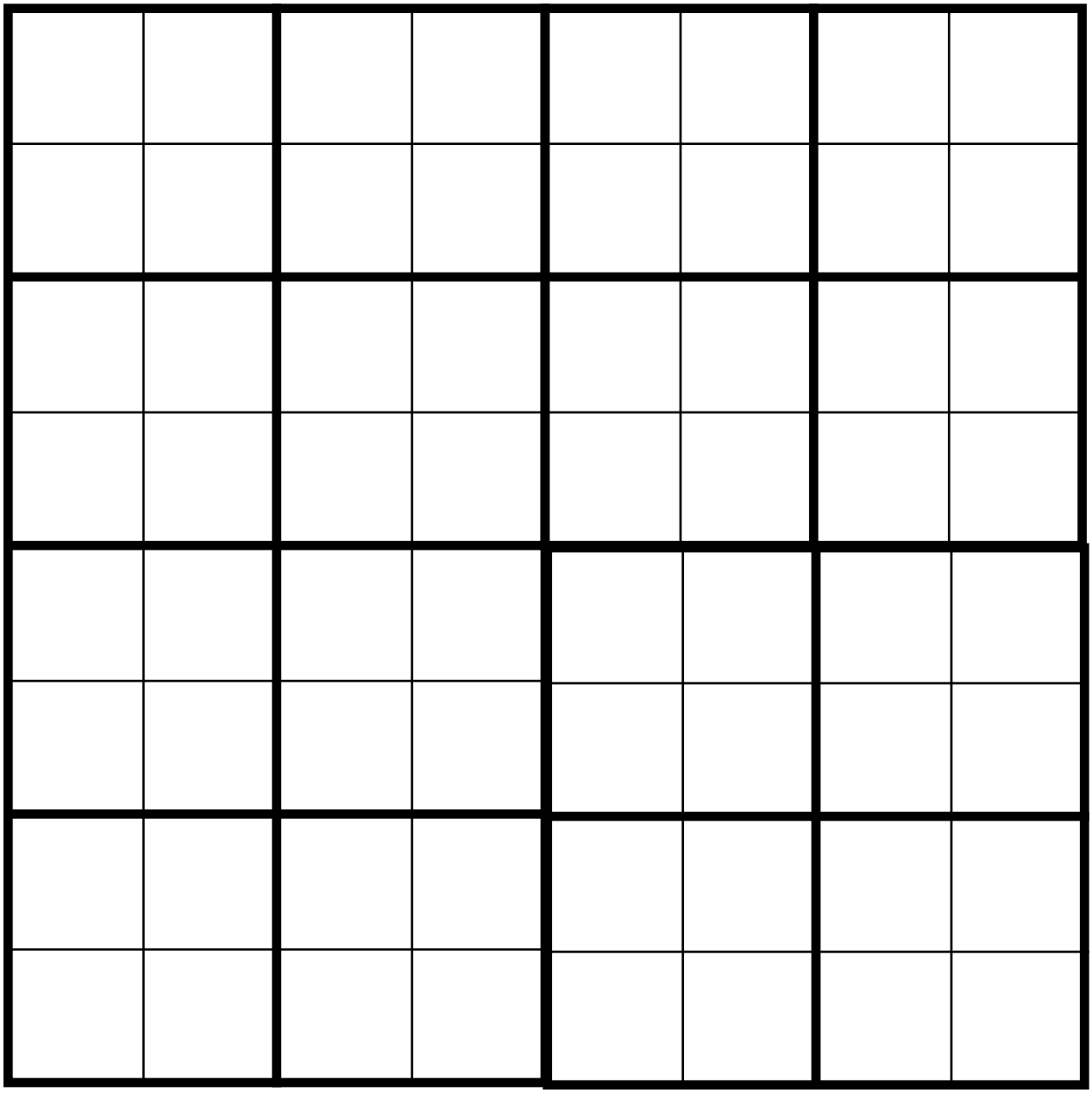
quarts _____

MATH JOURNAL QUESTION

What is the easiest way to win this game? Explain your reasoning.

Go for the Four Gallons

Go for the Four Gallons - Student Resource 3a
(Multilink Cubes)



What fraction of your four gallons is...

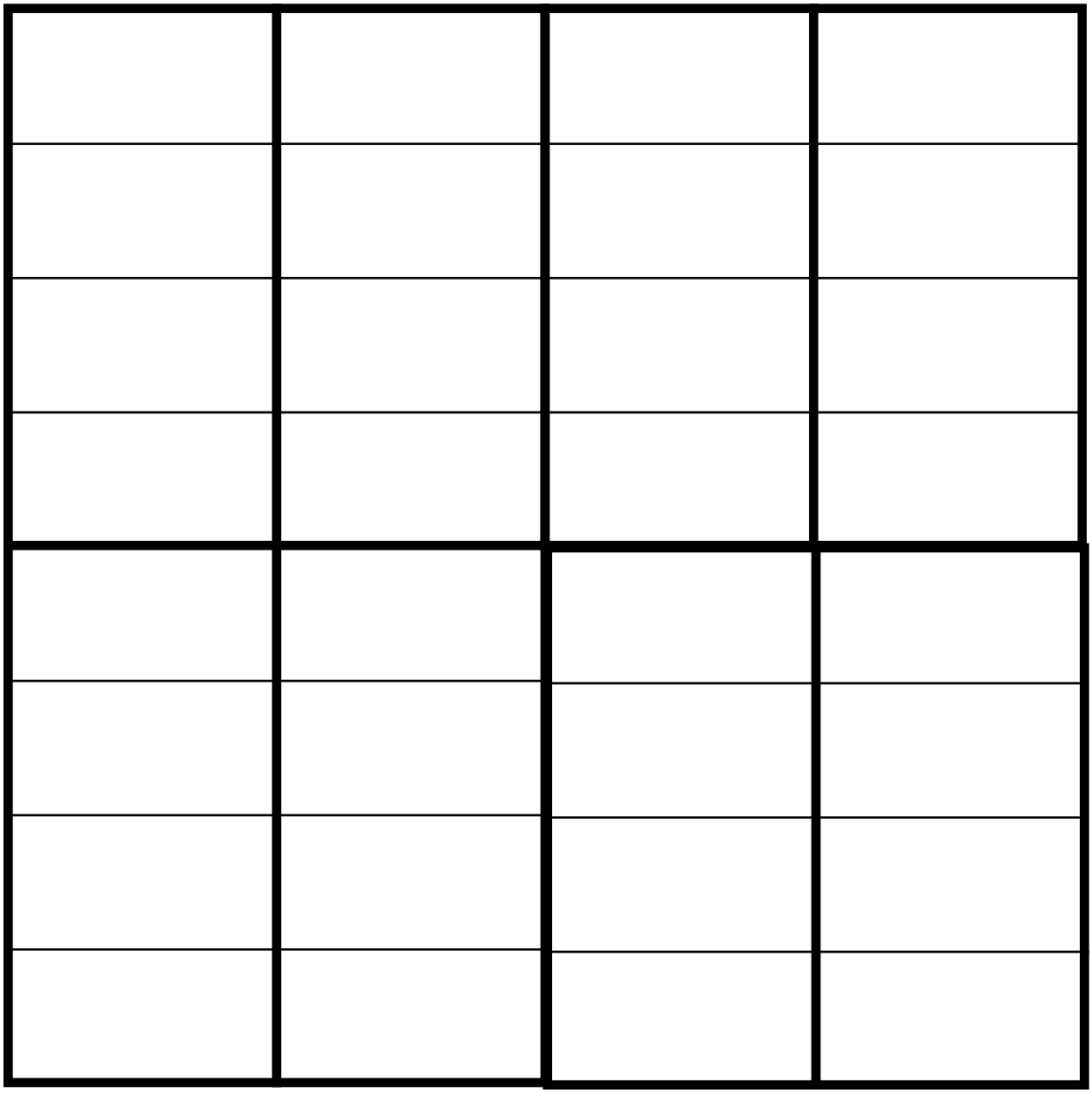
Half-pints _____ Pints _____

Quarts _____

Color in one gallon on the gameboard above. What fraction of the four gallon gameboard is one gallon? _____

Go for the Four Gallons

Go for the Four Gallons - Student Resource 3b
(Unifix Cubes)

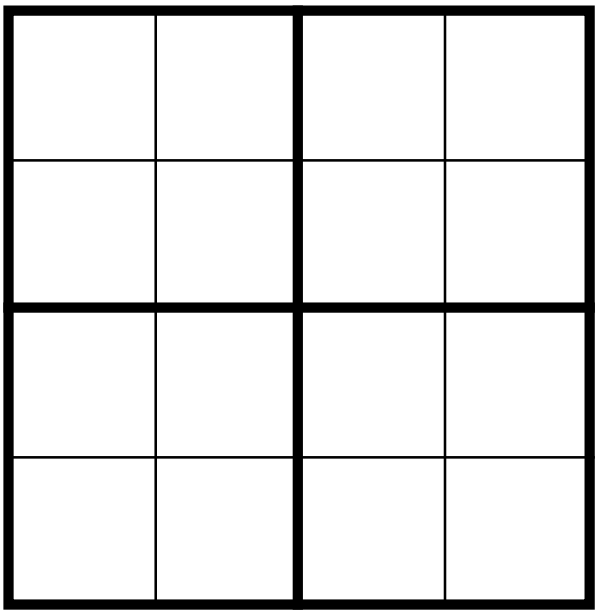


What fraction of your four gallons is...

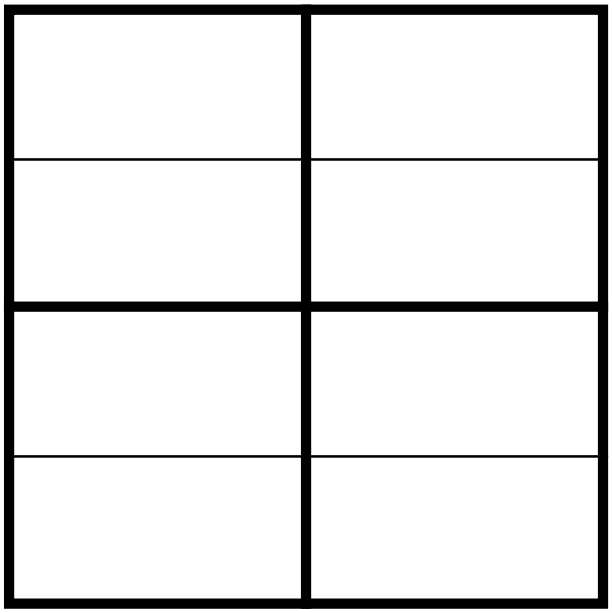
Half-pints _____ Pints _____

Quarts _____

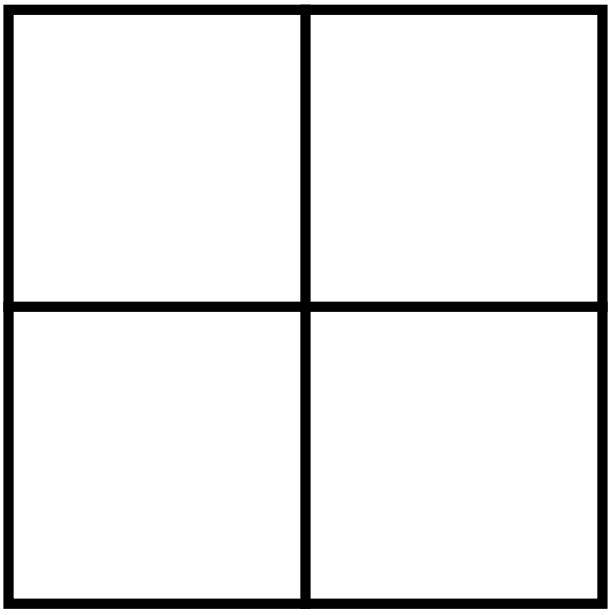
Color in one gallon on the gameboard above. What fraction of the four gallon gameboard is one gallon? _____



Cups in ounces

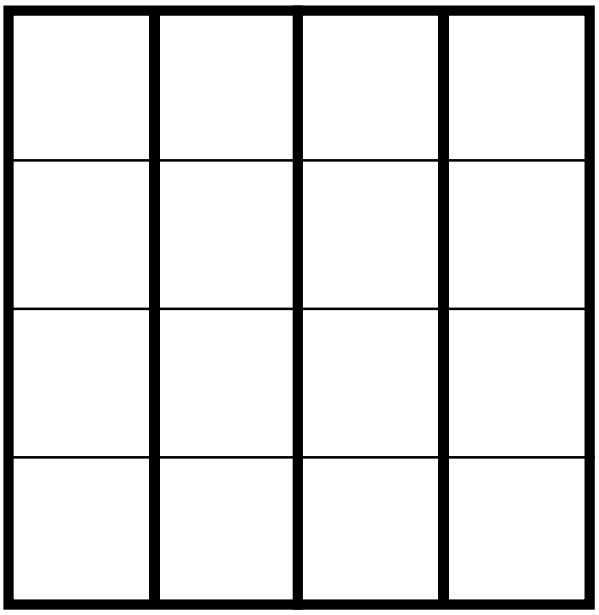


Pints in ounces

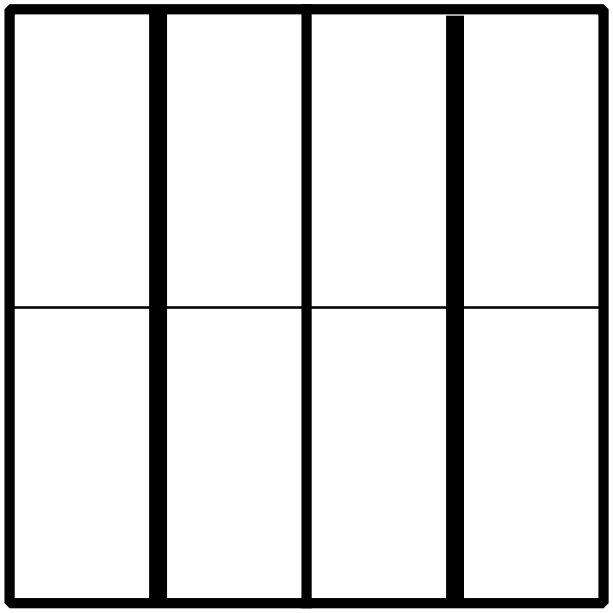


Quarts in ounces

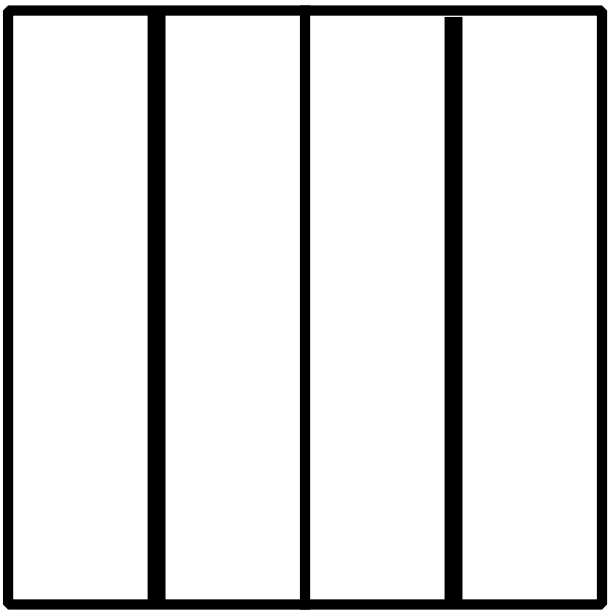
Go for the Gallon - Student Resource 4b
(Unifix Cubes)



Cups in Ounces

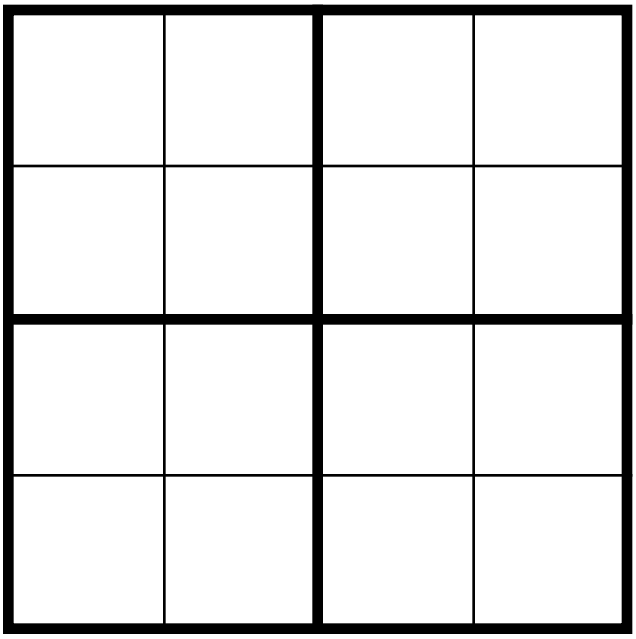


Pints in ounces

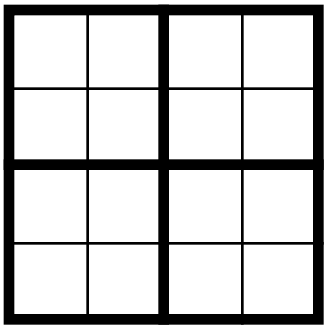


Quarts in ounces

Go for the Gallon



Game 1



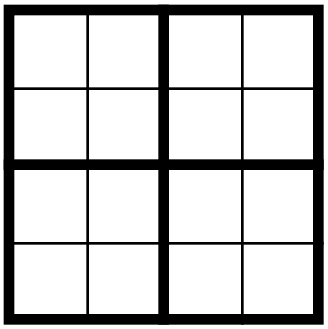
What fraction of your gallon is ...

cups _____

16 ounces _____

32 ounces _____

Game 2



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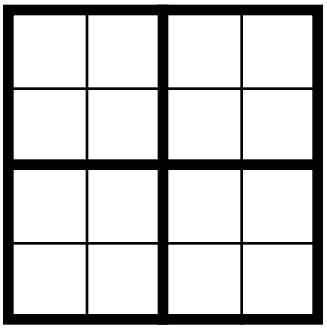

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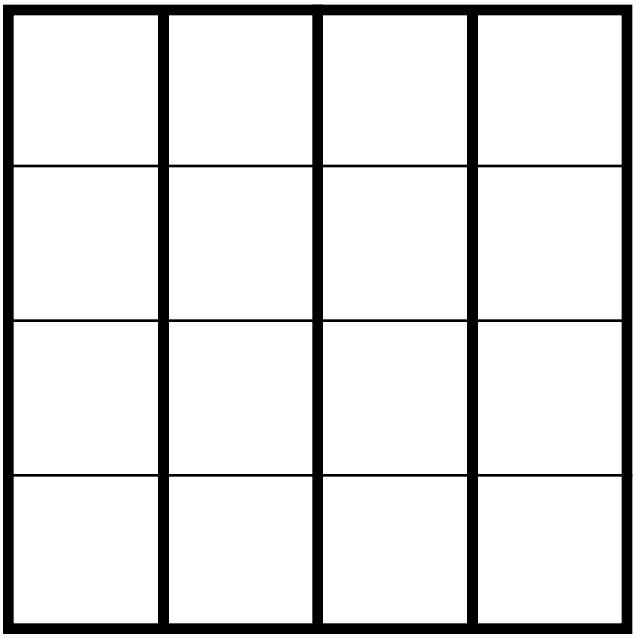
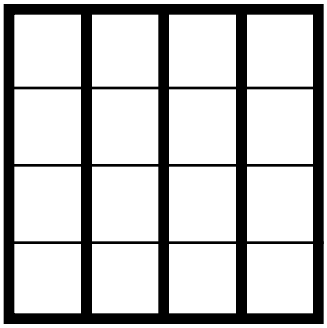
Go for the Gallon



Game 1



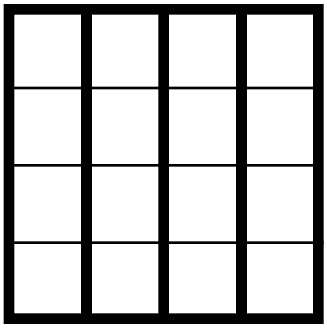
What fraction of your gallon is ...

half-pints _____

pints _____

quarts _____

Game 2



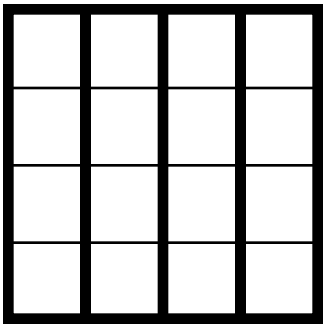
What fraction of your gallon is ...

half-pints _____

pints _____

quarts _____

Game 3



What fraction of your gallon is ...

half-pints _____

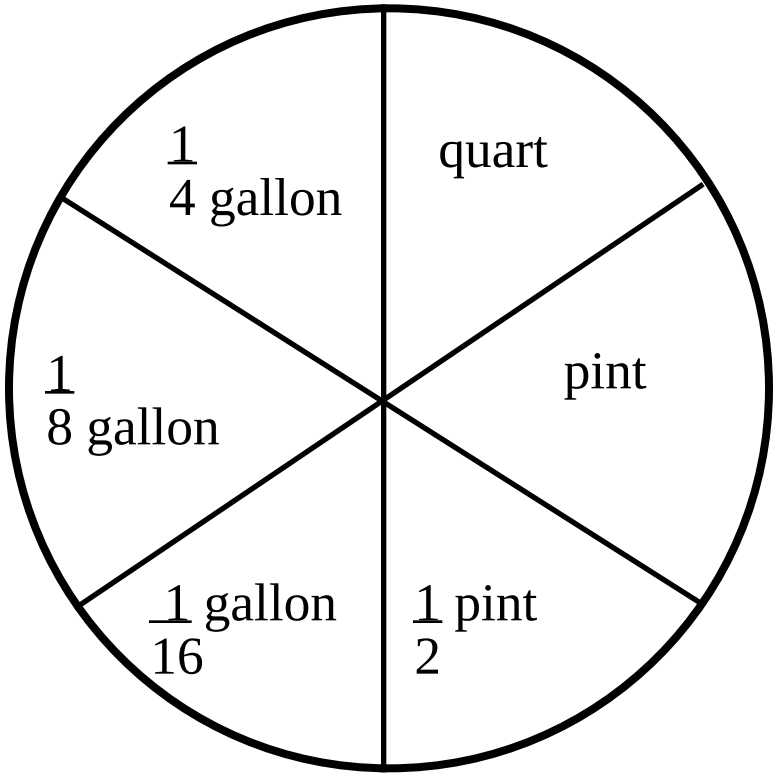
pints _____

quarts _____

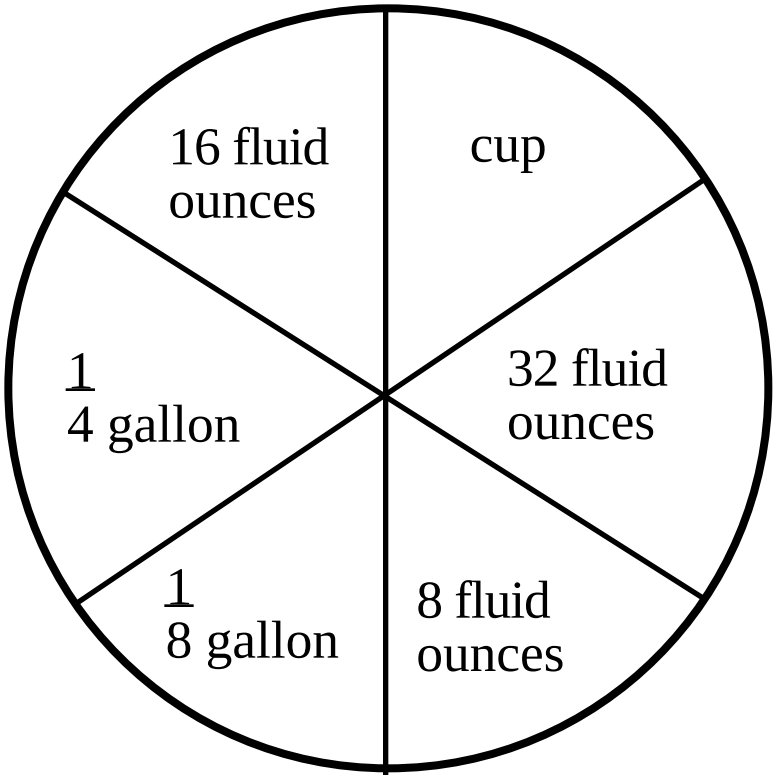
MATH JOURNAL QUESTION

What is the easiest way to win this game? Explain your reasoning.

Go for the Gallon Spinners



Day 1



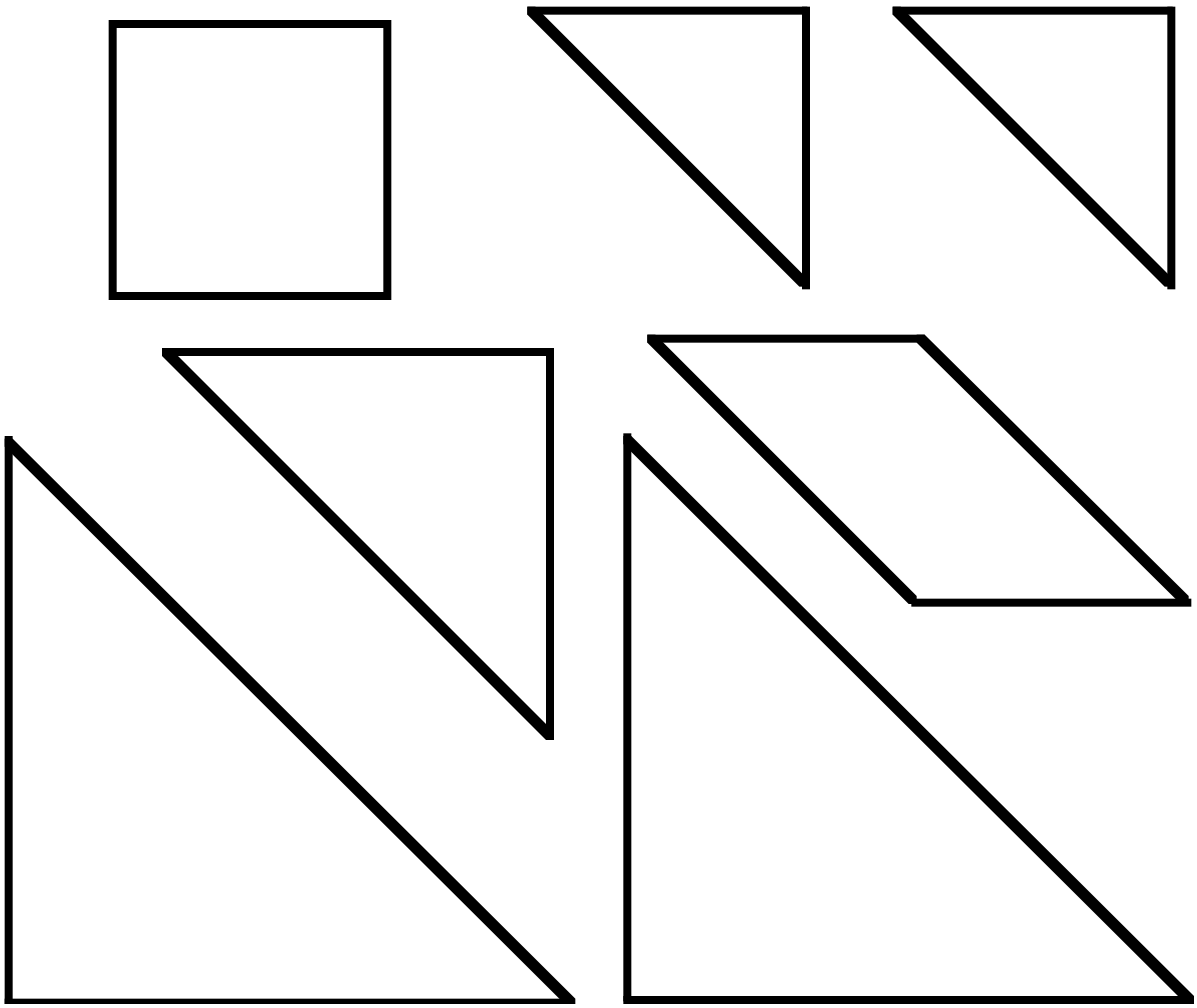
Day 2

Tangram Gallon Activity

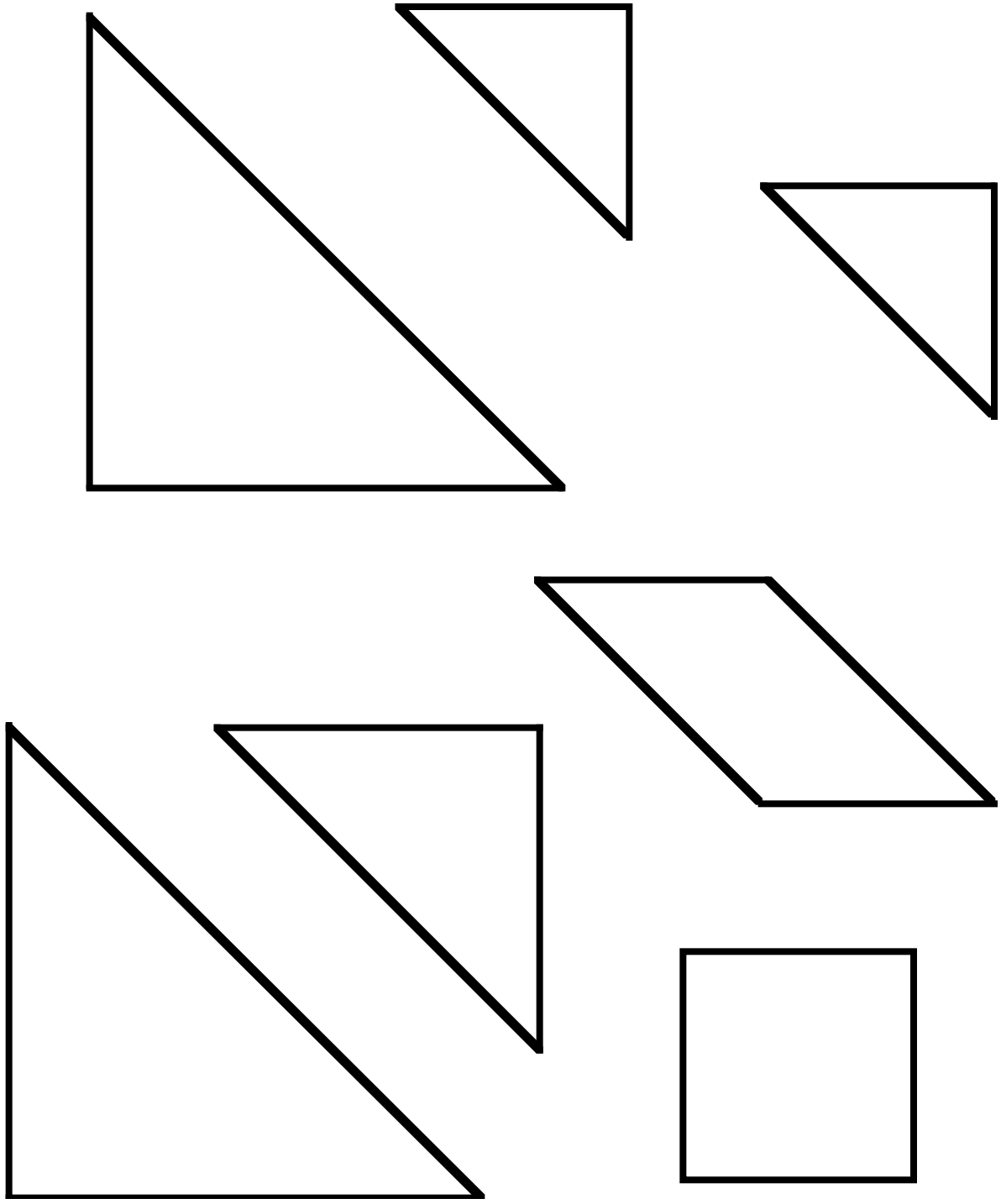
1. Use your tangrams to make one large square.

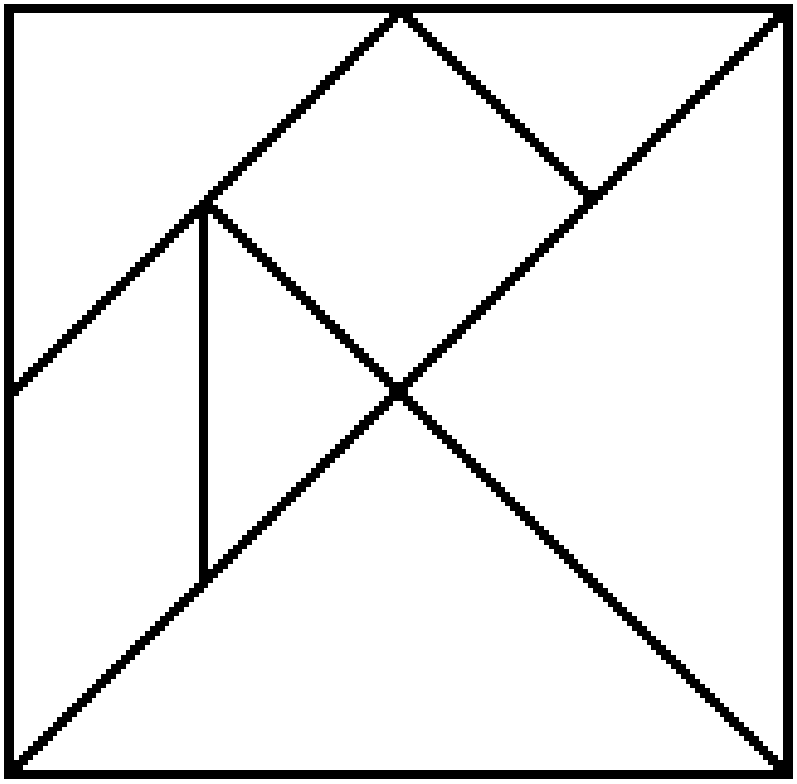
2. If your large square is one gallon, what fraction of a gallon is each piece? Write your fraction on each tangram below.

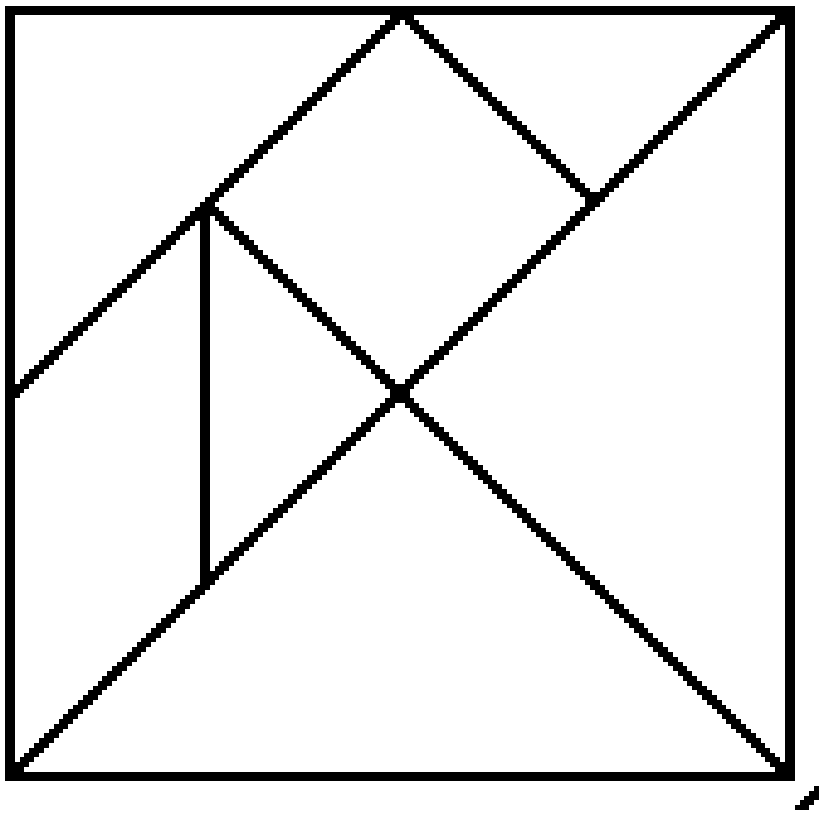
3. In your math journal, explain why you named two different tangram pieces (not identical) the way you did. Be sure to use the fraction words we have been using the last two days.



Tangram Pieces







Name _____ Date _____

Homework

Answer the following questions. You may have to use a dictionary to research some of the answers.

1. There are 31 and 1/2 gallons in a barrel. How many gallons are in two barrels?

_____

2. What is a hogshead?

_____

3. What fraction of a hogshead is one gallon?

_____

Name _____ Date _____

Homework

Answer the following questions. You may have to use a dictionary to research some of the answers.

1. There are 31 and 1/2 gallons in a barrel. How many gallons are in two barrels?

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3. What fraction of a hogshead is one gallon?

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LIQUID CAPACITY TOOL MAKING PROJECT

Group Member's Names and Jobs

Name	Job

Name Of Your Tool

Materials Needed To Make Your Tool

Description Of Your Tool And Instructions For Its Use

LIQUID CAPACITY TOOL MAKING PROJECT - SCORING RUBRIC

- Includes measures of liquid capacity (such as half-pint, cup, pint, quart, gallon, and ounce) or fractions and fractional equivalents
- neatness of the product
- cooperation between partners
- a detailed written description of the tool and a complete set or rules

Students receive one point for each standard that is met.